Clinical trials on continuous measurement of fetal $tcPco_2$

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We have used the $tcPco_2$ registration in addition to the supervision of the fetus during labor by cardiotocography (CTG) and fetal blood analysis. We use a modified Severinghaus electrode (Radiometer E 5230) at a measuring temperature of 39°C respectively 44°C (2). By comparing the transcutaneously measured data with the values measured in the fetal blood it is possible to answer some specific questions of $tcPco_2$ monitoring in the fetus (1): In order to test the reliability of the $tcPco_2$ registration at different measuring temperatures we analysed the correlation between Pco_2 of the FBA and the synchroneously registered $tcPco_2$ at 39°C ($\bar{r}$ = 0.74, p 0.001, slope : 1.05, intercept: +8.57, n = 111) and oompared this result with the analysis at 44°C (Fig. 1).

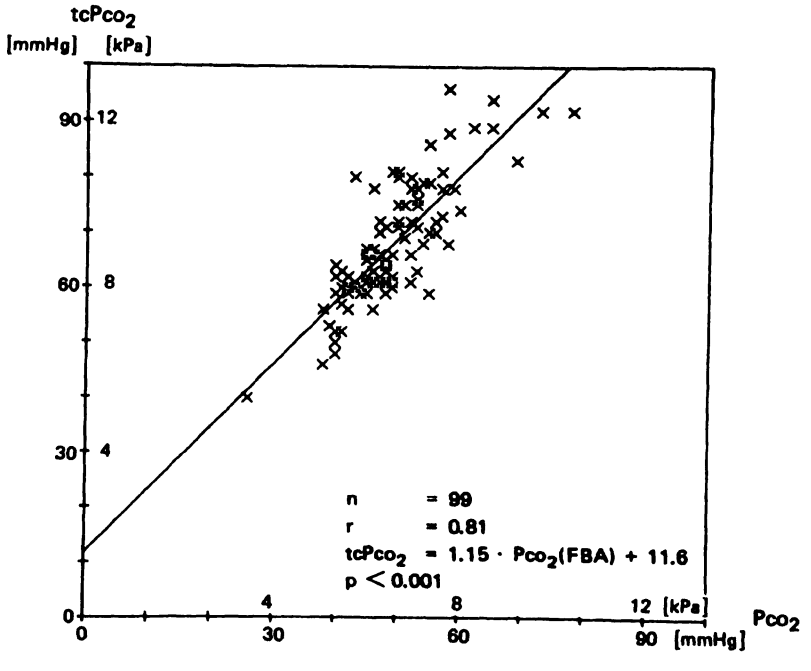

Fig. 1

While at both temperatures the correlation is significant ($p < 0.001$), due to Co_2 production in the tissue and the effect of the raised temperature, the transcutaneous values exceed the values of the fetal blood (at 44°C to a greater extent than at 39°) (3). By comparing data of cases in which a caput succedaneum developed with cases where no such phenomenon occurred, we were able to elicit its influence on the $tcPco_2$ measurement (Tab.I). We also analysed the influence of the duration of the transcutaneous measurement on its accuracy (Tab. II).

caput succedaneum	correlation (R)	significance	intercept	slope	number of values
39°C –	0.78	< 0.001	10.84	1.01	28
39°C +	0.72	< 0.001	11.78	0.99	83
44°C –	0.82	< 0.001	14.68	1.09	74
44°C +	0.80	< 0.001	3.18	1.28	25

Tab. I

A caput succedaneum has a considerable influence on the reliability of the $tcPco_2$ measurement especially when the prechosen temperature is 39°C while measurements at 44°C seem to be less accurate after registration of 150 min. As one basis of fetal surveillance is the intermittent pH measurement the correlation of the $tcPco_2$

duration of measurement	correlation (R)	significance	intercept	slope	number of values
< 150min 39°C	0.86	< 0.001	11.92	0.98	13
> 150min 39°C	0.83	< 0.001	7.60	1.11	14
< 150min 44°C	0.93	< 0.001	8.16	1.21	24
> 150min 44°C	0.79	< 0.001	7.41	1.24	20

Tab. II

with the pH is of great clinical importance. In the range between a pH level of 7.25 to 7.50 we find the $tcPco_2$ values to be rather scattered. However with pH value dropping to 7.24 (pre-acidosis), all $tcPco_2$ values of this study at 44°C and not corrected, are >70 mmHg (Fig. 2).

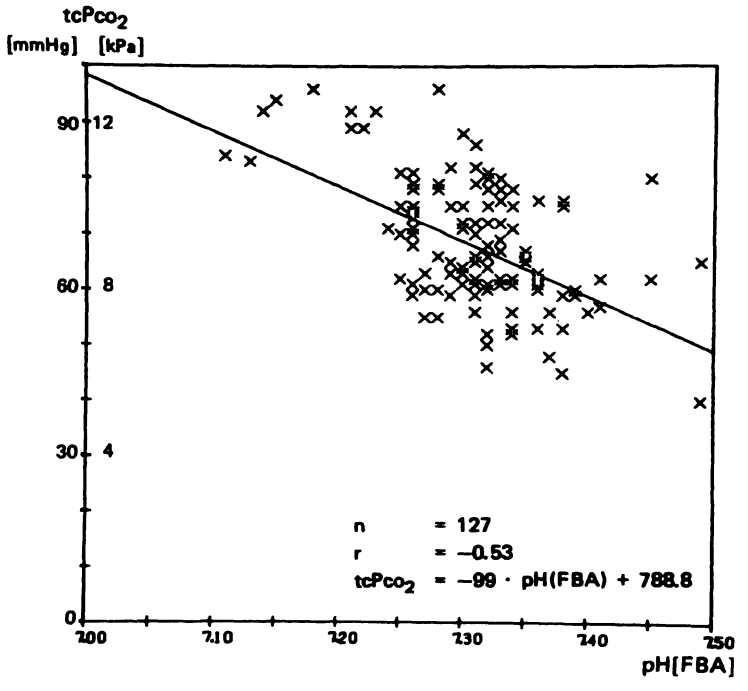

Fig. 2

If we only then perform an FBA when the indication emerged from an irregular heart rate pattern, and additionally this level of 70 mmHg is exceeded, a considerable number of FBAs could be spared. (This action line should be confirmed by additional measurements). Furthermore the timing of an obstetrical operation may be optimised. During our clinical trial the occurrence of an acute complication was in all instances clearly indicated by a rise of the $tcPco_2$ value from its original level. All these babies, in spite of acidosis, were born by immediate operation before clinical signs of depression (Apgar <7) had manifested.

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